FACT SHEET

MDA FACT SHEET

SPACED BASED LASER (SBL)

INTRODUCTION

The Space-Based Laser (SBL) is an element of the Boost Defense Segment. The SBL could provide the National Command Authorities with a highly reliable missile defense and space superiority weapon. If deployed, SBL would provide a substantial capability affording the nation continuous global presence and precision engagement at the speed of light. SBL would appreciably contribute to the boost-phase layer of a robust BMD system. Working with sea- and air-based missile defenses, the SBL could negate a significant number of attacking missiles during their vulnerable boost phase and subsequently reduce the burden on mid-course and terminal phase defenses. The SBL could be instrumental in protecting airfields and ports in the early stages of a conflict. Additionally, because of its global presence, SBL will be available to protect U.S. Allies and coalitions. The threat of debris falling on the aggressor's own territory could also deter the use of chemical, biological and nuclear warheads.

DESCRIPTION

The SBL project is managed by MDA with participation by the U.S. Air Force, through a joint-venture contractor team consisting of Boeing, Lockheed Martin and TRW.

Near-term SBL activity will focus on design validation and risk reduction activities supporting an Integrated Flight Experiment (IFX), which will provide an on-orbit lethal demonstration of SBL technologies by 2012. The SBL IFX program will include ground, flight and space experiments that will verify SBL technologies at the component, subsystem and system levels. This strategy will allow us to resolve the integration challenges inherent in combining precision optics and high energy lasers into a lightweight spacecraft. A thorough series of ground tests of the vehicle prior to its flight will be conducted in order to develop a database to analyze on-orbit performance. Using data obtained from the IFX effort, the cost and utility of an operational system will be assessed, forming the basis for a recommendation on whether or not to develop, produce and deploy an operational space-based laser as part of a future missile defense architecture. In parallel with the IFX experiment, other enabling technologies supporting an operational SBL, such as large lightweight deployable optics, will be developed and demonstrated.

ADVANTAGES

- The SBL system is designed to intercept missiles in their boost phase, thus possibly deterring the use of deadly warheads due to the potential of payload debris falling on the launcher's territory.

- In the boost phase, targets are large and slow moving, making them more vulnerable to intercept.

- The SBL system provides continuous global coverage, which allows for the protection of the U.S. and its Allies.

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ELEMENTS

The SBL effort is comprised of several closely coordinated, parallel activities. The first activity is continued design validation and risk reduction of the four major components of the SBL, the laser, the beam control system, the beam director, and the acquisition and tracking system.

Laser: The laser provides the energy that will be used to destroy the missile. The SBL laser burns Hydrogen and Fluorine in a chemical reaction to produces HF molecules in an excited state. It then uses an optical resonator to extract energy from the excited molecules in the form of laser light to produce a megawatt-class high power beam. The HF laser is ideally suited for operations in space. It is scaleable to the powers needed for an operational system. The weights of the fuels needed to produce the HF laser beam are very light compared to power sources for other lasers. And the HF laser is thermally efficient in that waste heat from the chemical reaction is exhausted into space and does not have to be absorbed and dispersed by the laser.

Beam Control: The beam control system corrects aberrations in the beam and transfers the high power beam from the laser to the beam director. The SBL beam control system uses sensors to measure aberrations and jitter in the outgoing beam, and adaptive optics such as deformable mirrors and fast-steering mirrors to correct them. The beam control system also takes a pointing reference from the tracker and points the beam toward the target missile.

Beam Director: The beam director expands the beam to a large diameter so that it will focus to a small spot on the target. The SBL beam director consists of a small (secondary) mirror that expands the beam and a large light-weight primary mirror that focuses the beam onto the distant target missile. The primary and secondary mirrors are held in position by a rigid support structure, but the surface of the large primary mirror is flexible and is actively controlled using multiple sensors and actuators. The primary mirror of an operational SBL will most likely be segmented into a center mirror petal and six outer petals. Segmenting the primary mirror allows the mirror to be folded during launch and then deployed once on orbit.

Acquisition and Tracking: The acquisition and tracking system acts as the eyes of the SBL. It detects the missile from the bright plume, and then steps through a series of sensors of increasing resolution to provide a highly accurate pointing reference for the beam control system. The tracker not only computes the position and velocity of the missile, it must also compensate for how far the missile will travel in the time it takes for the laser beam to travel the distance from the SBL to the target missile.

SBL Integrated Flight Experiment (IFX): The second activity is the SBL IFX design, fabrication, integration, test, and flight experiment. The integration of the major SBL components discussed above into a space experiment addresses key challenges to the program: “autonomous operation in the space environment” and “performance of major components as part of an integrated system.” Data from the flight experiment will be used to validate design models and assess the cost and utility of an operational SBL constellation.

Performance Test Facility (PTF): The third activity of the SBL program is the design and construction of the SBL IFX Performance Test Facility (PTF). The PTF is needed for full power tests of the laser and integrated system before committing the payload to launch.

Advanced Deployable Optics: Although an operational SBL will probably use a segmented primary mirror, the sub-scale flight experiment does not need or use them. A separate effort of experiments and demonstrations will demonstrate the feasibility of deployable optics needed for the operational system in parallel with the fight experiment. Major areas of development include light weighting of mirrors, mirror structure integration and control and subsystem tests on latches, isolators and actuators.

SBL Operational System: No decision has been made to deploy an operational SBL, however this fourth activity explores the cost, technology, operations, and policy issues that would be associated with an operational system. A High Energy Laser Affordability and Architecture Study was recently completed to define the most promising BMD concepts and help guide the technology investments and experiment goals of this effort. The study confirmed earlier analyses that concluded that a HF chemical laser was the most mature technology and still the most cost-effective path toward a first generation SBL.

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